

EXHIBIT A SCOPE OF SERVICES

MINNESOTA CULVERT DESIGN GUIDANCE FOR AQUATIC SPECIES PASSAGE AND STREAM CONNECTIVITY

BACKGROUND

Minnesota has ~92,000 miles of streams and rivers and 142,000 miles of roads. Minnesota streams and rivers are an integral part of our state's natural and economic landscape. These two networks intersect numerous times, often with a stream passing beneath the roadway in a culvert. Historically, these crossings have been designed with the safe passage of roadway traffic in mind. Recently there has been wide acknowledgement that allowing for passage of stream "traffic" (fish and other aquatic organisms) is also important to maintain aquatic connectivity of in-stream habitat. Culverts can become barriers when conditions exceed fish or aquatic organism ability by: excessive drop at outlet, insufficient pool depth, excess flow velocity, excessive turbulence, or behavioral barriers.

Although a number of published resources on aquatic organism passage design exist, there is no single guide to inform designers which solutions are appropriate and effective in Minnesota. The design of culverts to accommodate aquatic organism passage (AOP) requires an understanding of organism habitat requirements, swimming ability and migration needs, as well as an understanding of how a culvert design will perform in a specific geomorphic and hydrologic context. Due to the variety of eco-regions found in Minnesota, variety of culvert geometries, and other factors, it is not likely that there is a single solution to accommodate aquatic organism passage through culverts. This project proposes to mine expert knowledge and synthesize existing AOP documents to develop a Minnesota Culvert Design Guidance for Aquatic Species Passage and Stream Connectivity.

OBJECTIVE

There is no central document for culvert design for aquatic organism passage in Minnesota. Lack of applicable design guidance and unfamiliarity by culvert installers may lead to sub-optimal designs as well as increased construction and maintenance costs. If the guidance document to be produced is used as intended by practitioners, benefits of the proposed project to Minnesota include:

- More efficient culvert design and permitting process for aquatic organism passage;
- A central definition of "typical" designs, leading to better contractor familiarity and lower construction costs;
- Avoidance of designs that could be detrimental to the natural environment;
- Avoidance of designs likely to lead to roadway damage and costly repairs;
- Improvement of economically valuable fisheries through increased stream connectivity.

SCOPE

This project is designed to develop a comprehensive and user friendly guidance of culvert design for fish passage in Minnesota. Feedback is sought at various points throughout the project to 1) inform the guidance document contents, 2) ensure the appropriateness of the design guidance, and 3) ensure the usability of the guidance document itself. A survey of practitioners will be conducted (Task 3) to evaluate the draft guidance document outline, and to identify key components of the document. This survey will be conducted on-line, in-person, and if necessary, by phone. In addition to the Technical Advisory Panel (TAP), regional experts in fish and other aquatic organism movement, culvert design, and fish passage will be identified to participate in two meetings: one to provide advice in defining the guidance document outline (Task 1), and the second to provide advice on revisions to the draft guidance document (Task 5). The guidance will include decision-making aids such as maps, selection tables, and flow charts which will allow engineers to select the most appropriate passage design based on the relevant parameters they have identified. In addition to AOP, the guidance will also incorporate principles of protecting upstream and downstream channel geomorphological connectivity. Engineering aids such as design charts and example design problems will be developed to guide the details of design. The guidance will attempt to explain, in an accessible manner and as concisely as possible, the research or reasoning behind the recommended techniques, to promote designers' confidence and ability to explain the purpose of their designs to reviewers and contractors.

ASSISTANCE

This project requires input from MnDOT, county engineers, the Minnesota Department of Natural Resources, the United States Forestry Services, the United State Fish and Wildlife Service and other stakeholders involved in aquatic organism passage. The University will seek input from these stakeholders as part of Tasks 1, 3, and 5.

WORK PLAN

Task Descriptions

Task 1: Identify Guidance Content and Develop Guidance Outline

Although a number of resources exist on aquatic organism passage design, there is no single guide to inform designers which solutions are appropriate and effective in different regions of Minnesota. This first task will identify the “limits” of the proposed guidance document in conjunction with the TAP and will seek advice from experts in fish and aquatic organism passage and stream geomorphology to ensure that all relevant resources are included. This task will include a meeting of regional experts on fish passage (outside of the TAP) to inform the guidance document outline. The goal of this task is to define the scope and outline the guidance.

Task 2: Literature Synthesis

Under this task, the University will identify existing aquatic organism passage culvert design, compile relevant reference and guidance materials, and synthesize content that is applicable to stream situations found in Minnesota. The project team will draw on the results of previous research and literature searches, and supplement this knowledge with recent studies from other sources. Likely literature sources include:

- Current and past research by the project team;
- Other relevant aquatic organism passage research reports;
- Federal agencies’ guidance documents (FHWA, USFS);
- Other states’ aquatic organism passage guidance documents;
- Permit requirements from DNR and other agencies;
- Databases of fish populations, stream attributes, and culvert data;
- Relevant best practices promoted by groups in Minnesota (if any).

A useful byproduct of the literature review will be the identification of gaps in knowledge, including situations where further research may be needed, including research specific to Minnesota.

Task 3: Survey Practitioners

Under this task, the University will survey a representative cross-section of highway design engineers and managers from MnDOT, county and city agencies, and engineering consultants. The University will conduct brief interviews, as well as use on-line or in-person surveys, such as at the Minnesota County Engineers Association annual conference. The purposes of the survey will be: 1) to identify current design practices for aquatic organism passage and geomorphic connectivity; 2) to ascertain the effectiveness (or ineffectiveness) of culverts which have been installed, including innovative local practices that have been successful; and, 3) to guide the content of the document to be written (i.e. what will be most useful to include).

Task 4: Prepare First Draft of Guidance for Review by the TAP

Under this task, the University will produce a readable guidance in draft form for review by the TAP, synthesizing the results of the previous tasks. Although the content should be largely in place, formatting of figures, tables, text, and design aids will be preliminary in nature.

Task 5: External Review

Under this task, the University will revise the draft document to incorporate TAP comments from Task 4. The University will review the newly revised draft guidance with the same engineers surveyed in Task 3 and those in the expert group identified in Task 1. The University will solicit input on content, presentation format, and ease of comprehension and use.

Task 6: Compile Guidance, TAP Review and Revisions

Under this task, the University will prepare a final draft guidance document, following MnDOT’s publication guidelines. This will also serve as the project report to document project activities, findings and recommendations. This guidance document will need to be reviewed by the TAP, updated by the research team to incorporate technical comments, and then approved by Technical Liaison before this task is considered complete.

Task 7: Editorial Review and Publication of Final Manual

During this task, the Approved Guidance document will be processed by MnDOT’s Contract Editors. The editors will review the document to ensure it meets the publication standard. This task must be completed within the contract time because the editors will provide editorial comments and request information from the Principal Investigator.

Task Deliverables

Task:	Deliverable(s):
1:	Task report including guidance document outline
2:	Task report including literature synthesis
3:	Task report including survey results
4:	Draft Culvert Design Guidance for Aquatic Organism Passage
5:	Summary report describing comments received
6:	A Draft Guidance and Final Guidance Approved for Publication
7:	Final Published Guidance Document (report)

PROJECT SCHEDULE

Task Durations

Months:	2016						2017											
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Task 1	X	X	X	X	X	X	X	X										
Task 2	X	X	X	X	X	X	X	X										
Task 3					X	X	X	X	X	X	X	X						
Task 4				X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Task 5																X	X	X
Task 6																		
Task 7																		

Months:	2018										
	19	20	21	22	23	24	25	26	27	28	
Task 1											
Task 2											
Task 3											
Task 4											
Task 5	X	X	X	X	X						
Task 6			X	X	X	X	X	X			
Task 7									X	X	

Deliverable Due Dates

Task:	Draft Deliverable Due Date:	Final Task Approval Date:
1:	December 31, 2016	February 28, 2017
2:	December 31, 2016	February 28, 2017
3:	April 30, 2017	June 30, 2017
4:	September 30, 2017	November 30, 2017
5:	March 31, 2018	May 31, 2018
6:	June 30, 2018	August 31, 2018
7:		October 31, 2018

Key Milestones

Key Milestone	Target Date	Description
TAP Meeting	July 11, 2016	Project Kick-off, Outline Content and Scope
Task 1 Milestone	October 31, 2016	Regional Experts Meeting - Scoping
TAP Meeting	January 4, 2017	Present Outline & Lit. (Task 1 & 2 Deliverables)
Task 3 Milestone	January 18, 2017	Practitioners Survey & Outreach
TAP Meeting	May 1, 2017	Submit Task 3 Deliverable
TAP Meeting	September 30, 2017	Present first draft guidance (Task 4 deliverable)
Action by TAP	November 30, 2017	TAP comments on draft back to research team
Task 5 Milestone	December 15, 2017	Regional Experts Meeting - Review Draft
Task 5 Milestone	January 17, 2018	Practitioners Follow-up Contacts
TAP Meeting	April 2, 2018	Present revised document (Task 5 Deliverable)
TAP Meeting	June 29, 2018	Present final guidance (Task 6 deliverable)
Action by TAP	July 31, 2018	TAP final comments back to researchers
Project Completion	October 31, 2018	Apply results

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